OCCASIONAL PAPER NO. 85 AUGUST 9, 1939

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

TRUCK LOGGING WITH DETACHABLE TRAILERS

by

R. R. Reynolds,
Associate Forest Economist,
Southern Forest Experiment Station.

The Occasional Papers of the Southern Forest Experiment Station present information on current Southern forestry problems under investigation at the Station. In some cases these contributions were first presented as addresses to a limited group of people, and as "occasional papers" they can reach a much wider audience. In other cases, they are summaries of investigations prepared especially to give a report of the progress made in a particular field of research. In any case, the statements herein contained should be considered subject to correction or modification as further data are obtained.

Note: Assistance in the preparation of these materials was furnished by the personnel of Works Progress Administration Official Project 365-64-3-7.

TRUCK LOGGING WITH DETACHABLE TRAILERS

by R. R. Reynolds,
Associate Forest Economist,
Southern Forest Experiment Station.

Introduction

The use of trucks and single- or dual-wheel trailers for logging in the South has increased very rapidly during the past 5 years. Because of the small initial investment, the small operating cost, and their extreme mobility and speed, in many cases trucks have replaced entirely the older railroad method of logging. Trucks also have helped to make possible partial or selective cutting, because a large tonnage of logs or pulpwood is not necessary to pay for the costly rights-of-way and spur tracks necessary in railroad logging.

Recent studies of truck logging made by the Southern Forest Experiment Station have shown that, although the truck method of logging is cheap and desirable, the method of loading the trucks generally is inefficient. This is mainly due to the fact that in loading a combination truck and trailer by cross haul it is necessary for the truck to remain idle during the loading for periods of 20 minutes to 1 hour (depending upon the size of the logs). Where the hauling distance is 7 to 10 miles (or less), the time "lost" in loading often would be sufficient to complete a round trip from the woods to the landing or mill with a load of logs.

Some lumber companies and logging contractors have increased the efficiency of logging trucks through the purchase and use of a machine-operated, boom-type loader mounted either on a truck or on a track-laying tractor. Many logging operators, however, have only a small amount of equipment and cannot afford to purchase a relatively expensive loader.

Nearly everyone that has been associated with truck logging at one time or another undoubtedly has thought of the possibility of using two trailers with each truck, in order that one may be loaded while the truck is on a trip to the landing with a load of logs on the other trailer. Possibly some attempts have been made to work out such a system, but most of these have failed because of (1) a weakness in the design of the device for supporting the trailer while being loaded or (2) the difficulty in coupling and uncoupling the loaded and empty trailers from the trucks.

A successful system, however, has been developed by A. G. Jacobson, Forester for the Fordyce Lumber Co. of Fordyce, Arkansas. This consists of an effective truck-hitch and a "horse" or standard that supports an empty, detached trailer in the woods while it is being loaded. This device also permits rapid and easy hooking to, and unhooking from, the truck of loaded or empty trailers.

Equipment Used and Method of Operation

Since the invention showed promise of making truck logging more effective and cheaper, the Southern Forest Experiment Station during the latter

part of 1938 initiated a study of the use of this equipment. The object of the study was to determine the output per day per unit of equipment and the cost per unit of volume when hauling over various distances logs of average size from selectively cut, second-growth, shortleaf-loblolly pine-hardwood stands.

Previous experience had indicated that, except for very short hauls, the combination of one truck or tractor unit to two trailers and two standards or "horses" was the most effective. Also, except for hauls of more than about 18 miles, two loading teams and drivers and one chain puller or loaderman are necessary. This, therefore, was the equipment used throughout the study. The truck, which was of regular 1½- to 2-ton rating and with 6 speeds forward, was equipped on the rear with dual wheels having 8.25- x 20-inch tires. The special combination fifth wheel and trailer hitch was mounted 6 inches ahead of the rear axle, in order to better equalize the load on both the front and rear wheels of the truck and thus keep the truck from jumping when starting with a heavy load. The specially built trailers were entirely of steel I-beam construction, with heavy axles and brake drums and with hydraulic-brake mountings. These were also equipped with dual wheels having 8.25- x 20-inch tires. Mounted over the springs and extending the entire length of the trailers were two well-braced I-beams, to which the bunks were fastened with U bolts. This construction eliminated the customary pole, permitted the easy adjustment of the bunks to take care of long or short logs, and made it possible to transform the log trailers into pulpwood trailers in only a few minutes. Both the ends of the bunks and the ends of the longitudinal I-beams were fitted with slots into which stakes could be placed. The "horses" or standards (see diagram), also constructed of heavy steel, consisted of two uprights spaced so that the rear truck wheels would exactly fit into a special runway built between them. The top of the uprights consisted of two heavy flat pieces of sheet steel built on an inclined plane with the bottom end about 3 inches lower than the upper portion, about 2 inches of which was bent parallel to the ground. The end of this level portion is fitted with a block or stop, and a catch or dog. Hinged to the frame on the outside are "wings" that can be placed so as to detach the trailer from the truck or turned out and away from the "horse" so that the trailer will pass through without being uncoupled from the truck.

In operation, the truck passes through the horse, stops momentarily until the wings are thrown into position to detach the trailer, and then proceeds Attached to the underside of the front bunk of the trailer, near the ends, are rollers which come in contact with, and roll up, the inclined plane, gradually lifting the trailer from the fifth wheel on the truck. The trailer, which is completely disconnected as the top or level portion is reached, is stopped by the blocks and held by the catches or dogs from rolling back down the inclined plane. In hooking to a loaded trailer, the truck backs into the horse, and the process is reversed.

When logs are being hauled, the truck drives through a horse that previously has been spotted for loading, drops the empty trailer, and drives to the trailer that has been loaded while the truck was hauling the previous load to the landing or mill. As soon as the truck leaves the woods with a load of logs, the empty standard is spotted in a location for another load, and the teams begin loading the empty trailer. In the present study, the loading was accomplished by means of the standard team cross-haul, but loading can be done by any method.

Records Obtained

Three different locations—one 9.8 miles, one 8.7 miles, and one 3.8 miles from the landing—were selected for the study, in order to determine the effect of distance (and roads) upon the cost of hauling, and in order to obtain logging conditions as typical as possible. In each case approximately 15 percent of the hauling distance was over ungraded woods roads and the remainder over gravel roads. The stands were cut selectively with the cut per acre ranging from 500 to 2,500 board feet. The following records were obtained:

1. Length of time required for the truck to exchange the empty trailer for a loaded one and begin the trip.
2. Travel time from woods to landing with load.
3. Unloading time at landing.
4. Travel time from landing to woods with empty trailer.
5. Delay time per trip.
6. Number of trips per day.
7. Number of logs per load.
8. Doyle and International Scale of each log and load.
9. Operating cost per day of truck, teams, and drivers.
10. Overhead, or ownership, costs per day.

Complete records were kept for a total of 21 operating days or for 156 loads. The ordinary standard bunk blocks were used on 128 loads, and on 28 loads specially built 30-inch stakes were used. All logs were cut into standard lengths of 12, 14, 16, and 18 feet, as required by the mill.

Results

As will be noted in table 1, the average amount of woods time, including the time required to unhook the empty trailer from the truck, to hook onto the loaded second trailer, and to start out of the woods with the load was 11.26 minutes per trip. The time required to haul a load of logs to the landing varied with the length of haul and also varied slightly from load to load for the same distance; on the average, however, it amounted to 3.45 minutes per mile of hauling distance. The unloading time averaged 11.11 minutes per load, and the time required to return to the woods with the empty trailer averaged 2.33 minutes per mile. To these figures must be added the time lost in making tire, truck, and trailer repairs and adjustments, and that caused by delays in hooking and unhooking the trailers, in unloading, etc. This amounted to 6.68 minutes per trip.

For a 5-mile haul, the total time per round trip amounted to 58.10 minutes; for a 10-mile haul, the total would be 87.15 minutes; for a 15-mile haul, it would be 116.20 minutes; and for a 20-mile haul, it would be 145.25 minutes. Throughout the study period the contractor's employees worked 8 hours per day, exclusive of the noon hour, and the contractor drove the truck on the last round trip each day; thus the truck was operated approximately 9 hours per day. On this basis, the number of round trips per day averaged approximately 10 for the 4-mile haul, $6\frac{1}{2}$ for the 9-mile haul, and 6 for the 10-mile haul. On the same basis, $4\frac{1}{2}$ trips would be made per 9-hour day on a 15-mile haul and 4 on a 20-mile haul.

Table 1.- Skidding, loading, and hauling cost per thousand board feet (Doyle scale) when using Jacobson standards and trailer equipment

Truck haul	Time per load				No. trips per day[2]	Total haul per day		Total cost per day[4]	Total cost per M board feet (Doyle scale)[6]	
	Truck haul time	Truck return time	Other truck time[1]	Total		Using bunk blocks[3]	Using stakes		Using bunk blocks	Using stakes
Miles	Minutes					Feet		Dollars		
4	13.92	9.32	29.05	52.29	10.33	16,745	19,741	31.69	1.89	1.61
5	17.40	11.65	29.05	58.10	9.29	15,059	17,753	31.69	2.10	1.79
6	20.88	13.98	29.05	63.91	8.45	13,697	16,148	31.69	2.31	1.96
7	24.36	16.31	29.05	69.72	7.75	12,563	14,810	31.69	2.52	2.14
8	27.84	18.64	29.05	75.53	7.15	11,590	13,664	31.69	2.73	2.32
9	31.32	20.97	29.05	81.34	6.64	10,763	12,689	31.69	2.94	2.50
10	34.80	23.30	29.05	87.15	6.20	10,050	11,848	31.69	3.15	2.67
11	38.28	25.63	29.05	92.96	5.81	9,418	11,103	31.69	3.36	2.85
12	41.76	27.96	29.05	98.77	5.47	8,867	10,453	31.69	3.57	3.03
13	45.24	30.29	29.05	104.58	5.16	8,364	9,861	31.69	3.79	3.21
14	48.72	32.62	29.05	110.39	4.89	7,927	9,345	31.69	4.00	3.39
15	52.20	34.95	29.05	116.20	4.65	7,538	8,886	31.69	4.20	3.57
16	55.68	37.28	29.05	122.01	4.43	7,181	8,466	31.69	4.41	3.74
17	59.16	39.61	29.05	127.82	4.22	6,841	8,064	31.69	4.63	3.93
18	62.64	41.94	29.05	133.63	4.04	6,549	7,720	5/25.19	3.85	3.26
19	66.12	44.27	29.05	139.44	3.87	6,273	7,396	26.19	4.02	3.41
20	69.60	46.60	29.05	145.25	3.72	6,030	7,109	25.19	4.18	3.54
21	73.08	48.93	29.05	151.06	3.57	5,787	6,822	25.19	4.35	3.69
22	76.56	51.26	29.05	156.87	3.44	5,576	6,574	25.19	4.52	3.83
23	80.04	53.59	29.05	162.68	3.32	5,382	6,345	25.19	4.68	3.97
24	83.52	55.92	29.05	168.49	3.20	5,187	6,115	25.19	4.86	4.12
25	87.00	58.25	29.05	174.30	3.10	5,025	5,924	25.19	5.01	4.25

1/ Woods time per trip, 11.26 minutes; unload time, 11.11; and delay time, 6.68 minutes.
2/ 9-hour day for contractor and truck, 8-hour day for employees; in dry weather.
3/ 1,621 board feet per load, Doyle scale.
4/ Truck cost $14.69; two teams and drivers, $13.00; chain puller, $2.00; and supervision, $2.00.
5/ Mileage at which one team can load truck; figure includes cost of only one team.
6/ Excluding contractor's profit.

The average load per trip when standard bunk blocks were used was 1,621 board feet Doyle scale, which is equivalent to about 2,273 board feet International $\frac{1}{4}$-inch scale. The average volume per load when the special 20-inch stakes were used was 1,911 board feet Doyle scale or approximately 2,680 feet International scale. The total volume hauled per day by one truck and two trailer units without special stakes was 16,745 board feet Doyle for a 4-mile haul; 10,763 for a 9-mile haul; and 10,050 for a 10-mile haul. For other distances, the volume that could be hauled has been computed in table 1.

As is to be expected, the original and operating costs of this equipment are greater than those of a truck and single trailer, and, as has been mentioned, two teams and drivers in place of the usual one per truck, are required per unit when the length of haul is less than approximately 17 miles.

Based on the best available information on depreciation and cost of repairs, the total operating cost for the truck, trailers, and standards amounted to $14.69 per 8-hour day. This included depreciation, interest on the investment, license and taxes, gasoline, oil, tires, greasing, and cost of the driver. The cost of the two teams and drivers amounted to $13.00 per day. (For distances over 17 miles, however, the cost would be half this amount, or $6.50.) The chain-puller and top-loader cost $2.00 per day, and for supervision $2.00 more per day per unit was allowed. Thus, on distances up to 17 miles the total cost per day per unit would be $31.69, and for distances over 17 miles the total cost would be $25.19 per day.

The cost per M board feet Doyle scale when using standard bunk blocks amounted to $1.89 for the 4-mile haul, $2.94 for the 9-mile haul, and $3.15 for the 10-mile haul. Although no actual hauling was done over other distances, the cost can be computed with accuracy, since the only variable is the hauling time, which is based on number of minutes required to travel a stated distance. The costs for other distances, therefore, have been computed; they are given in table 1, in which is given also the cost per unit volume when special stakes are used in place of bunk blocks. As indicated, these figures do not include the contractor's profit and risk and, therefore, are net costs per unit volume.

These figures are of especial interest when compared with the cost of skidding, loading, and hauling with lighter trucks and single trailers under the system commonly used throughout the South. Under similar road and hauling conditions, and with logs of the same average size and length, this shuttle-type trailer system will undoubtedly produce logs $0.50 to $2.00 (depending upon the length of haul) per M board feet cheaper than the standard system. Further savings are also indicated, because additional use of this new and unusual equipment undoubtedly will bring about more efficiency. The amount of time spent in hooking, unhooking, and unloading apparently can be reduced considerably, and it seems entirely reasonable that by the use of stakes all loads can be built up to 2,000 board feet, roads permitting, regardless of the size of the logs.

Sufficient information on the possibilities of using this equipment for the hauling of pulpwood is not yet available, but it is known that the trailers will hold the equivalent of 5 standard cords of wood and that the full loads on the standards can be hooked onto as easily and effectively as can loads of logs. On a short test over a 10-mile haul, mostly on gravel roads, the truck and two trailers with two teams and wagons and five men loaded and hauled an average of about 23 standard cords per day.

DETACHABLE TRAILER AND "IRON HORSE"